The Association among Neighborhood Socioeconomic Status, Race and Chronic Pain in Black and White Older Adults

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The association among race, neighborhood socioeconomic status (SES), and chronic pain has not been well examined in older people. Clinical data was obtained from older adults (>50 years old) presenting to a tertiary care pain center. The relative roles of race and neighborhood SES on the chronic pain experienced in older black and white adults were assessed.

Older blacks experienced more affective pain, pain-related disability and mood disorder symptoms than older whites. Confirmatory factor analysis confirmed previously hypothesized factors for the McGill Pain Questionnaire pain dimensions and the Pain Disability Index. Exploratory and confirmatory factor analyses also identified factors in the Brief Symptom Inventory and neighborhood SES. Structural equation modeling showed black race was associated with lower neighborhood SES and also with increased affective pain, obligatory disability and mood disorders mediationally through neighborhood SES. It was indirectly associated with increased sensory and miscellaneous pain, and voluntary disability through low neighborhood SES. Racial interaction examination showed that neighborhood SES had the same relationship to outcomes by race.

We found increasing neighborhood SES is associated with decreasing negative chronic pain outcomes for older blacks and whites. Our data provide evidence that both race and neighborhood SES are important factors to consider when examining the chronic pain experience among older Americans.

Key words: race/ethnicity ■ socioeconomic status ■ elderly health ■ minorities ■ health disparities

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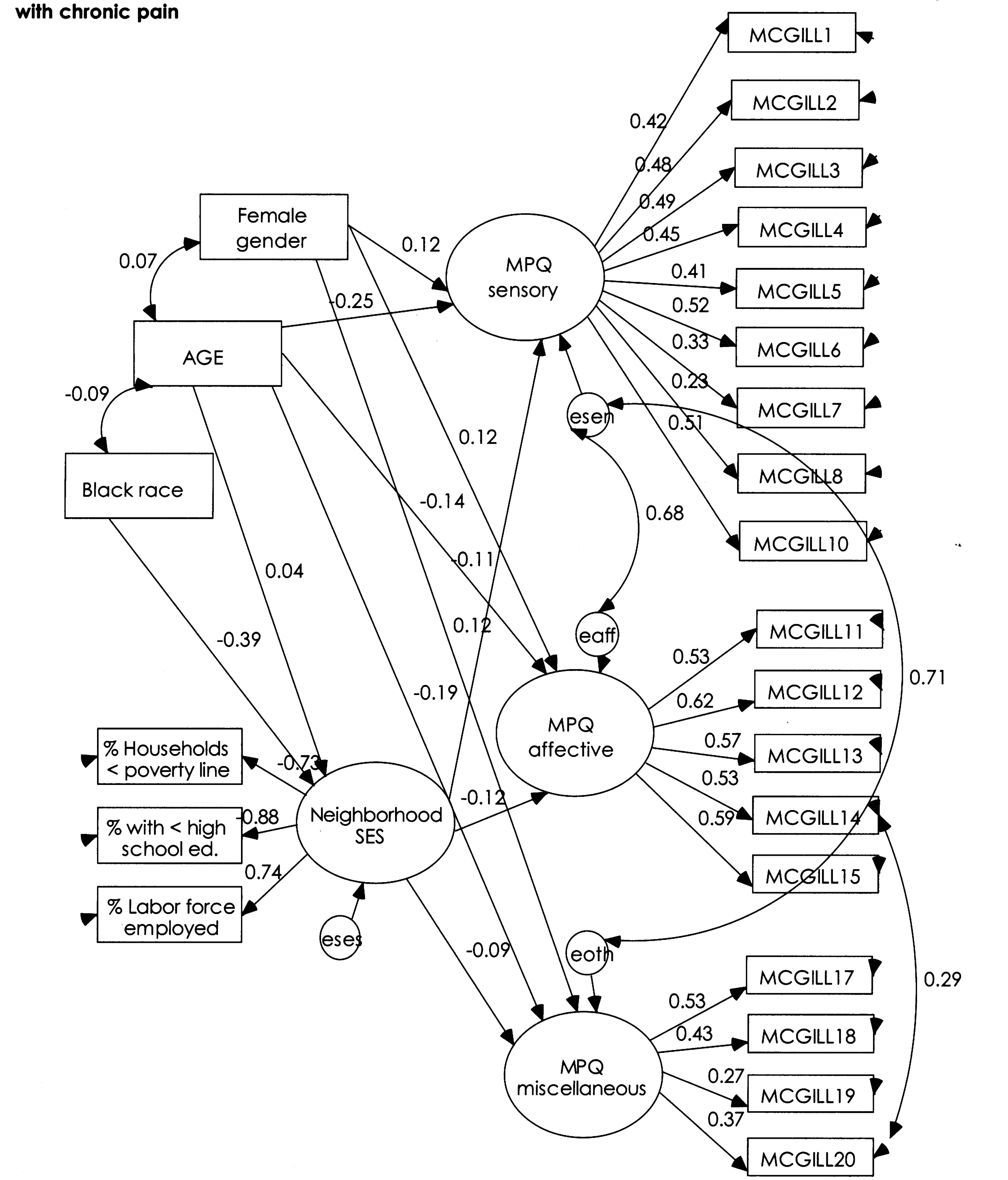
INTRODUCTION

Disparities in health based upon race are well outlined.[1,2] Individual (i.e., preferences, mistrust), health system (i.e., access, provider treatment) and societal (i.e., segregation, discrimination) causes are often implicated in disparities.[1] Navarro asserts that racial health disparities cannot be understood without considering social class.[3] Although some studies find that neighborhood disadvantage accounts for racial disparities,[4,5] others find disparities persist after considering class.[6,7] While not all racial differences can be explained by SES, such as in the case of asthma[8] and premature mortality,[9] Williams asserts that understanding SES is critical in understanding health disparities.[10-12] The compounding effect of residential concentration and disparate allocation of socioeconomic resources by neighborhood contributes to the strong relationship between race and health.[13] Living in disadvantaged communities influences personal health and is associated with several chronic conditions such as obesity and heart disease even after controlling for personal SES, age and race.[14,15] All in all, both race and class have separate and interactive effects in producing health disparities.[16] Race and socioeconomics are entangled constructs sometimes interacting and sometimes acting individually,[10,17] but further complicated by aging. This is particularly important since changes in socioeconomic status (SES) with aging differ for blacks and whites, yielding[10] differential aging. Specifically, accelerated aging is attributed to stress[18] and low social status,[19] and is more prevalent in blacks, making age an important consideration when examining issues health disparities.

Several studies attempted to control for SES in analyzing the chronic pain experience.[20-22] People in lower socioeconomic groups report more chronic pain symptoms.[23,24] Lower-SES Americans with chronic pain report lower quality of life[25] and are at increased risk for chronic disabling pain.[26,27] The association between race and chronic pain is mixed, with some studies suggesting that blacks report more pain and negative sequelae due to pain than whites, while others find no racial disparities.[20,28] Although the relationship between race and chronic pain and the relationship between SES and chronic pain were studied, the more complex, interactive relationship was not examined. This begs questions as to whether the relationship is one in which SES explains most of the variance, or, like premature mortality, whether race plays a significant and independent role? An important caveat is that older people have chronic pain at twice the rates of younger people, yet chronic pain in older minority adults is understudied.[28,29] These observations have added weight in an increasingly diverse and aging society. Considering the increasing prevalence of pain, these findings highlight the importance in understanding how SES and chronic pain impact successful aging in an ethnically diverse and aging population.

Socioeconomic factors were predictive of chronic disabling pain in Portenoy's community-based survey study, although race was not studied.[26] The relationship between race and class is complicated and may also change with

Figure 1. Race, neighborhood socioeconomic status and pain characteristics in black and white patients with chronic pain



age,[30,31] emphasizing the importance of examining race, SES and health with attention to specific age groups. Neighborhood SES measures may tap into similar dimensions as personal SES.[32] However, when controlling for preferences and personal SES, blacks are less likely to move from disadvantaged neighborhoods than whites. Decreased migration may indicate perceived discrimination, thereby influencing residential choices.[33,34] Thus, neighborhood SES is not a proxy for individual SES, but is a strongly related indicator for many health outcomes.[35] Additionally, measures of SES that account for several components (e.g., income, education, employment) are preferable to single measures. This is particularly true in racial comparisons since different measures of SES present their own advantages and disadvantages.[10]

Matching U.S. Census data to addresses is widely used to define neighborhoods.[35,36] When the unit of application is small (e.g., tract or block), U.S. Census data provide relatively homogenous indicators for the areas where people live and interact most frequently.[35] In fact, census data is commonly used as the gold standard for measuring neighborhood SES.[37] We hypothesized that neighborhood SES predicts chronic pain-associated outcomes more strongly than race for blacks and whites in an older adult population with chronic pain. We examined the relationship among race, neighborhood SES, and pain-related outcomes in an older adult population. For purposes of this study, we chose those ≥50 years of age since they are more likely to have chronic pain and due to the probable changing relationships among race, neighborhood SES and pain-related outcomes over time in an attempt to disentangle these factors with age changes. This study aims to: 1) validate commonly used measures in different racial, age and gender groups; and 2) determine the relative role of neighborhood SES (i.e., percentage of census tract living below 100% of the poverty line, percentage of census tract with less than a high-school education and percentage of labor force employed within the census tract) and race on the chronic pain experience in black and white older adults.

METHODS

Subjects

The University of Michigan Health System's institutional review board provided approval for this retrospective and nonprobability study. Clinical data was collected by self-report in the form of the patient assessment and narrative (completed by patients upon initial chronic pain assessment) at a tertiary care pain center from 1993–2000. Informed consent was waived. All black or white patients ≥50 years attending the multidisciplinary pain center during the study period were included. Other races were excluded because the numbers in each group were too small for analysis.

MEASURES

Demographics included were age, race (0=whites, 1=blacks), gender (1=females, 0=male), education (1=<high school, 2=high-school graduate, 3=some college and college graduate) and employment (0=working full or part time, 1=unemployed). Several well-validated measures were used to assess pain severity, disability and mental health.

We matched subject's recorded address to 2000 U.S. Census tract data using Arcview 3.0 to provide neighborhood SES. Percentages were calculated for each variable of interest as used previously[36,38] since absolute census numbers are driven by tract population size and are not comparable across tracts. The variables included in the current analysis (percentage of households be-

Appendix. Definition of the McGill Pain Questionnaire items used in the Confirmatory Factor Analysis

Subscale	Word Descriptors
MPQ1:	Flickering, quivering, pulsing, throbbing, beating, pounding
MPQ2:	Jumping, flashing, shooting
MPQ3:	Pricking, boring, drilling, stabbing, lancinating
MPQ4:	Sharp, cutting, lacerating
MPQ5:	Pinching, pressing, gnawing, cramping, crushing
MPQ6:	Tugging, pulling, wrenching
MPQ7:	Hot, burning, scalding, searing
MPQ8:	Tingling, itchy, smarting, stinging
MPQ9:	Dull, sore, hurting, aching, heavy
MPQ10:	Tender, taut, rasping, splitting
MPQ11:	Tiring, exhausting
MPQ12:	Sickening, suffocating
MPQ13:	Fearful, frightful, terrifying
MPQ14:	Punishing, grueling, cruel, vicious, killing
MPQ15:	Wretched, blinding
MPQ16:	Annoying, troublesome, miserable, intense, unbearable
MPQ17:	Spreading, radiating, penetrating, piercing
MPQ18:	Tight, numb, drawing, squeezing, tearing
MPQ19:	Cool, cold, freezing
MPQ20:	Nagging, nauseating, agonizing, dreadful, torturing

low the poverty line, percentage of people ≥25 years old with less than a high-school education and percentage of people in the labor force who are employed) were used to identify the neighborhood SES latent factor. We determined it was unnecessary to control for clustering of addresses since the 1,844 addresses that were successfully matched came from 1,060 census tracts. This broad distribution (i.e., 91% of tracts had ≤3 residents; only two tracts had >9 residents) indicates minimum impact caused by the concentration of census data. Calculations were done according to a process previously outlined, and the intracluster coefficient was 0.07 with a design effect of 1.07.[39] A design effect of <2 signifies that tract-level variance has a small effect on results such that the results are valid without taking clusters into account.[40]

The McGill Pain Questionnaire (MPQ) measures pain severity via 20 sets of descriptive words and is widely used clinically (Appendix). The three MPQ subscales with multiple indicators (sensory, affective and miscellaneous) as well as the total score were used in the analysis.[41] The literature reports reliabilities of 0.96 and 0.95 for the sensory and affective subscales. Although our sample reliabilities were lower (α=0.68 and 0.67, respectively), they were within an acceptable range. Dropping item 9 improved reliability of the sensory scale to 0.71, so this was done in scale creation. The affective scale could not be improved. Since both age and race may affect MPQ reliability, the differences noted may be due to these factors.[42,43] Reliabilities in this sample were higher for blacks than whites. While the miscellaneous subscale was not adequately reliable for scale use (α=0.45), factor loadings were adequate for use as latent factor indicators (Figure 1). So the miscellaneous items were used only as a factor and not as a scale. Scale items indicated the associated latent factors.

The Pain Disability Index (PDI) is a seven-item self-report instrument that measures the degree pain interferes with functioning via seven domains: family/home, recreation, social activity, occupation, sexual behavior, self-care and life-support (0=no disability, 10=total disability within each subscale, 70=maximum disability for the whole scale). A weighted mean (allowing for up to two missing responses) was used in the descriptive analyses. Psychometric analysis indicated adequate reliability (α=0.84) and construct validity. A two-factor solution that includes voluntary (i.e., family/home, recreation, social activity, occupation, sexual behavior) and obligatory (i.e., life support, self-care) items was used for structural equation modeling.[44]

The Brief Symptom Inventory (BSI) is a 53-item self-report mental health symptom inventory. The items were designed to be used with medical, psychiatric and community samples and form nine subscales related to psychiatric diagnoses: (depression, anxiety, somatization, paranoid ideation, phobic anxiety, psychoticism, interpersonal sensitivity, obsessive-compulsive and hostility).[45,46] Reported reliabilities for the subscales range from 0.71–0.85. Subscale totals (representing standardized T scores), as opposed to individual items, were available for analysis. Since the summary scales for BSI had not formerly been determined, we performed exploratory factor analysis to determine latent factors. Three latent factors were indicated by the nine scales: 1) "mood disorders" latent factor (i.e., depression, anxiety and somatization), 2) "psychotic disorders" (i.e., paranoid ideation, phobic anxiety and psychoticism), and 3) "other disorders" (i.e., interpersonal sensitivity, obsessive compulsive disorder and hostility). Since "mood disorders" are extremely prevalent among chronic pain patients and other psychiatric symptoms less so, it was the only BSI factor included in further analyses.

Figure 2. Race, neighborhood socioeconomic status and pain interference with functioning in black and white patients with chronic pain

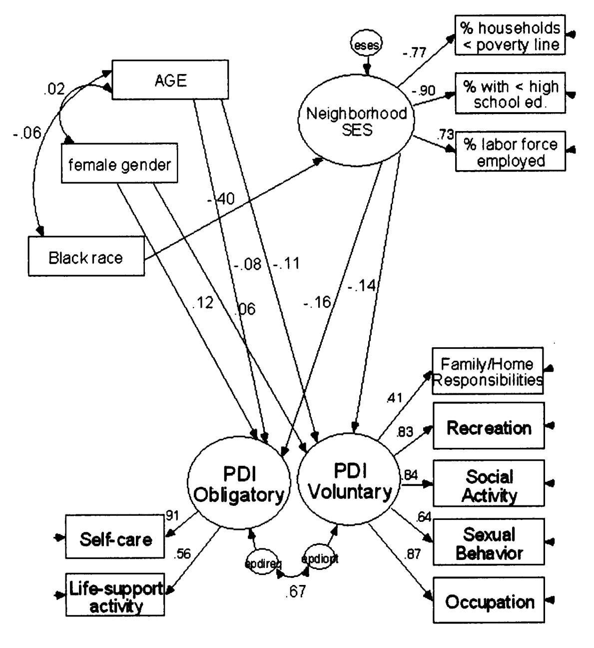
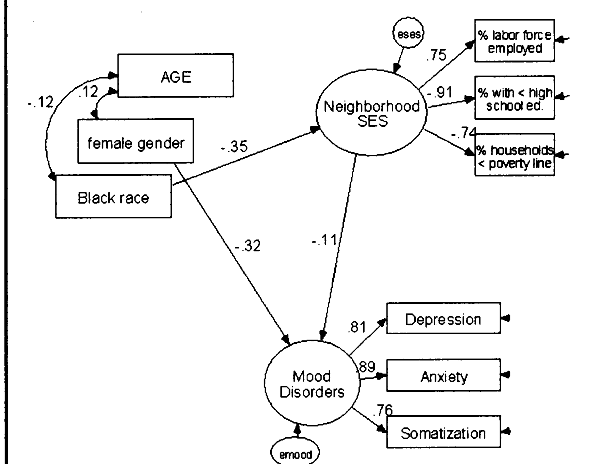


Figure 3. Race, neighborhood socioeconomic status and mood disorders in black and white patients with chronic pain



Statistical Analysis Plan

We performed statistical analyses using the Statistical Package for Social Science® (SPSS), version 12.0 software and AMOS 5.0.® First, we computed descriptive statistics and compared variables in the analysis for racial differences using ANOVA. Second, we performed confirmatory factor analysis for neighborhood SES, MPQ, PDI and BSI to test the measurement models for latent factors. We also tested latent factors for each instrument for invariance by race, gender and age group (50–64 years vs. ≥65 years). Third, we used structural equation modeling (SEM) to test the relationships among race, neighborhood SES and the outcome variables: 1) MPQ components, 2) PDI components, and 3) BSI "mood disorders." In all cases, we began modeling with a saturated model, removing insignificant paths one at a time, and finally tested for the mediating and moderating effects of neighborhood SES within each model. Mediation was tested as outlined previously.[47-49] In nested models, we held the path from neighborhood SES to each significant outcome at 0 one at a time and compared the constrained and nonconstrained models using the likelihood ratio χ^2 as a measure of difference. To test for moderation, parallel models for the separate racial groups were run comparing the strength of paths between the two models as recommended.[47,48] All fit indices and thresholds were evaluated using recommendations of Hu and Bentler.[50]

RESULTS

Sample Descriptives

For the 2,070 people studied, 1,906 were white (92.1%) and 169 blacks (7.9%). Blacks were younger ($p<0.001$), and there were no gender differences between blacks and whites (59.2% vs. 60.1% female, $p=0.85$). Most subjects were high-school graduates; blacks were more likely to have not finished high school than whites (34.9% vs. 23.8%, $p=0.008$). Geomapping successfully matched addresses for 89% of the sample (n=1844). For all neighborhood SES measures, blacks lived in more disadvantaged neighborhoods than whites ($p\leq0.001$ for all comparisons), with higher percentages of unemployed, people below the poverty line and people with less than a high-school education. There were no differences based on age, race, gender or marital status for participants whom addresses could or could not be matched. Additional descriptive information for the sample is provided in Table 1.

Overall, pain severity and sensory pain were not different for blacks and whites. Blacks experienced more affective pain ($p=0.003$) and pain-related disability ($p<0.05$ for both measures) than whites (Table 2). Blacks also had higher mood disorder index scores than whites ($p=0.006$).

Confirmatory Factor Analysis

Fit statistics and invariance limitations for all latent factors are shown in Table 3. Factors were tested for invariance by racial group, gender and age group (50–64 vs. ≥65). Measurement models were the same by race, gender and age except where noted in Table 3 ($p>0.05$). Figures 1–3 (correspond to SEM results) show standardized factor loadings for the latent factors. Neighborhood SES, MPQ, PDI and BSI were confirmed to have the hypothesized latent factors. Only item 9 within the MPQ sensory factor (Appendix) did not load and was dropped from the factor.

Structural Equation Modeling

Only subjects for whom there were complete data were used in structural equation modeling (n=1,839 for SES and demographic model, n=1,799 for MPQ, n=1,203 for PDI, n=1,146 for BSI). Blacks and less-educated people were more frequently missing MPQ data, though the

Table 1. Sociodemographic descriptive statistics and comparison of black and white participants

	Total	Blacks	Whites	P Value
	(n=2,070)	(n=164)	(n=1,906)	
Age (Mean ± SD)[b]	62.8 ± 9.9	60.0 ± 9.3	63.0 ± 9.9	<0.001
% 50–64 years old[a]	59.9	74.4	58.7	<0.001
% ≥65 years old[a]	40.1	25.6	41.3	
Gender (% women)[a]	60.0	59.2	60.1	0.850
Education (%)[a]				
% <High school	38.424.7	48.834.9	37.523.8	0.003008
% ≥ High-school graduate	61.675.3	51.265.1	62.576.2	
Neighborhood SES (mean±SD)				
% people below the poverty line[b]	8.51 ± 8.6	20.91 ± 13.9	7.45 ± 7.1	<0.001
% with <High school education[b]	14.6 ± 8.9	24.0 ± 11.9	13.8 ± 8.1	<0.001
% eligible who are employed[b]	62.3 ± 8.7	53.89 ± 12.2	62.98 ± 7.9	<0.001
Median household income ($)[b]	53,406 ± 20,823	36,382 ± 17,145	54,859 ± 20,466	<0.001

SES: Socioeconomic status; a: Comparisons made via Chi-squared comparison; b: Comparisons made via analysis of variance number of cases missing is small. Women and less-educated people were missing more disability information than men and more educated people. Higher education was associated with more missing BSI information. Standardized results are presented in all figures and in the text except for group comparisons (moderation tests), where comparison of standardized results can be misleading.

Race, age, gender and neighborhood SES. Age is significantly correlated with both gender ($r=0.07$, $p=0.003$) and race ($r=-0.10$, $p<0.001$), with women and whites being older. Demographically, only black race was individually associated with lower neighborhood SES ($\beta=-0.39$, $p<0.001$). Fit of the model was acceptable (SRMR=0.035, RMSEA=0.11, IFI=0.94, χ^2(df 7)=152.53). The moderation test found relationships did not differ by race.

Race, age, gender, neighborhood SES and pain. Black race was not directly related to any of the pain factors; however, it was indirectly associated with all three pain factors through neighborhood SES. Thus, blacks lived in neighborhoods with lower SES and that was associated with higher scores for each pain component. The fit of the model after eliminating the insignificant paths from race to pain was acceptable (SRMR=0.077, RMSEA=0.06, IFI=0.84, χ^2(df 239)=1,695.0). Fit could not be improved without overidentifying the model. Factor loadings and standardized path weights are shown in Figure 1.

To test mediation of race through neighborhood SES, paths from neighborhood SES to the pain components were held at 0 one at a time in nested comparisons to examine the significance of the direct race effects. The paths from race to sensory pain and miscellaneous pain remained insignificant, but the path from race to affective pain became significant ($\beta=0.07$, $p=0.004$), indicating mediation. Thus, sensory and miscellaneous pain are affected by race only indirectly through neighborhood SES; affective pain is related though the mediated effect of neighborhood SES (i.e., blacks having higher affective pain can be explained by living in lower SES neighborhoods).

The third test assessed the moderating effect of race. The model was split by race to compare the path size; no significant differences were found between the model run with blacks and that run with whites. The paths from neighborhood SES to sensory pain ($b_{Black}=-2.09$, $b_{White}=-1.41$, $p_{dif}=0.42$), affective pain ($b_{Black}=-1.31$, $b_{White}=-0.61$, $p_{dif}=0.26$) and miscellaneous pain ($b_{Black}=-1.26$, $b_{White}=-1.12$, $p_{dif}=0.96$) consistently showed stronger paths for blacks, but racial differences in those path sizes were not significant. Thus, age, gender, race and neighborhood SES are related to pain outcomes in the same way for older blacks and whites.

Race, age, gender, neighborhood SES and pain disability. Race was not directly associated with the PDI factors, although neighborhood SES significantly predicted both factors. Removing the racial paths to PDI allowed the best fit (SRMR=0.038, RMSEA=0.06, IFI=0.95, χ^2 (df 58)=318.48 (Figure 2). Therefore, race was related indirectly to PDI through neighborhood SES.

Mediation tests found that the path from race to pain disability for obligatory activities became significant ($\beta=0.08$, $p=0.001$), indicating that the racial effect on pain-related obligatory disability was entirely mediated by neighborhood socioeconomic status. The path to voluntary activities, however, did not become significant. This means that blacks have higher disability for obligatory activities through lower neighborhood SES, but black race was only related to disability in voluntary activities indirectly.

In the model split by race, higher neighborhood SES predicted lower disability for both races with no significant differences in path size by race. The paths from neighborhood SES to obligatory ($b_{Black}=-4.09$, $b_{White}=-3.03$, $p_{dif}=0.71$) and voluntary ($b_{Black}=-2.12$, $b_{White}=-4.13$, $p_{dif}=0.36$) disability (due to pain) were different in degree but these differences were not significant. However, there were gender and age interactions with race. Age is related to slightly less voluntary disability for whites

Table 2. Health measure means, standard deviations and racial comparison using analysis of variance

	Total (n=2,070)	Blacks (n=164)	Whites (n=1,906)	P Value
Pain Characteristics (Mean ± SD)				
Total MPQ score	23.8 ± 12.4	25.4 ± 15.0	23.6 ± 12.2	0.084
Sensory PRI*	12.8 ± 7.8	13.6 ± 8.8	12.7 ± 7.7	0.158
Affective PRI	3.2 ± 3.2	3.9 ± 4.2	3.1 ± 3.0	0.003
Pain-Related Disability (Mean ± SD)				
Total PDI score	38.4 ± 14.7	42. 4 ± 14.0	38.03 ± 14.8	0.003
Obligatory activities	5.7 ± 4.1	6.6 ± 4.4	5.57 ± 4.1	0.005
Voluntary activities	22.9 ± 8.4	24.7 ± 7.9	22.73 ± 8.4	0.015
Mood Disorders (Mean ± SD)				
Total BSI© mood disorders score	179.5 ± 25.8	186.1 ± 26.0	179.0 ± 25.8	0.006
Anxiety	60.4 ± 11.3	63.4 ± 11.6	60.1 ± 11.2	0.002
Depression	62.1 ± 10.6	63.8 ± 12.2	62.0 ± 10.4	0.064
Somatization	64.7 ± 20.1	63.1 ± 62.1	64.9 ± 9.9	0.316

MPQ: McGill Pain Questionnaire; PDI: Pain Disability Index; * Item 9 was dropped from the Sensory MPQ scale. A weighted sum was used so numbers would be comparable to norms.

(b=0.03, p=0.22) but slightly more for blacks (b=-0.02, $p<0.001$; χ^2_{dif}=5.11, p_{dif}=0.02). Female gender is related to higher disability for blacks (b=0.70, p=0.05) and lower for whites (b=-0.12, *p*=0.33; χ^2_{dif}=4.83, p_{dif}=0.03).

Race, neighborhood SES and mood disorder symptoms. Black race was not associated with mood disorder symptoms, so the direct path was dropped. Age was also not related, though gender was (β=-0.32, $p<0.001$), such that females have fewer mood disorder symptoms. The fit of the final model was acceptable [SRMR=0.039, RMSEA=0.07, IFI=0.96, χ^2 (df 25)=155.8; Figure 3]. When the effects of neighborhood SES were fixed at 0, there was a significant association between black race and mood disorders (ß=0.08, p=0.007) indicating mediation. Blacks have more mood disorder symptoms, mediated by neighborhood SES.

In the split-model neighborhood, SES was predictive of fewer mood disorder symptoms for both blacks (b= -6.08, p=0.01) and whites (b=-12.26, $p<0.001$) but was not statistically different (p=0.55). The paths from gender to mood disorder symptoms were also not different (p=0.72), suggesting the same relationship exists for blacks and whites.

DISCUSSION

In a multiethnic, multiracial, multicultural and aging society, it is increasingly important to examine health disparities in the chronic pain experience. To our knowledge, this is the first study examining the relative association of race and neighborhood SES with the chronic pain experience in ethnically diverse older adults. Using structural equation modeling (SES), we found black race was associated with lower neighborhood SES in this population. We further demonstrated the complicated relationship that black race and neighborhood SES have on pain-related outcomes supporting the importance of considering race and neighborhood SES when evaluating chronic pain in older adults. Since neighborhood SES sometimes mediated race and sometimes did not, we believe that SES and race should not be used interchangeably in analysis. Rather, race and SES constructs have a complex relationship with pain outcomes deserving further exploration.

Factor Structure

SES has often been indicated by a single measure (e.g., income, education, poverty).[38,51] The neighborhood SES latent factor represented three important SES components (i.e., poverty, education, employment). To achieve racial and gender invariance, the education variable needed to be freed to differ by group supporting both Williams and Smith suggestion that different SES components may differ by race.[10,52] Our findings validate the literature suggesting SES is too complex to be represented by an individual construct. Furthermore, incorporating poverty, education, and employment provides better validity and stability.[52] The invariance also indicates that education played a stronger role for whites than blacks, consistent with Williams.[10] This finding suggests

Table 3. Constructs, latent factors[a], fit statistics and limitations to invariance

Construct	Latent Factors Identified	CFA Fit	Limitations/Invariance
Neighborhood Socioeconomic Status	Single latent factor (poverty, education and employment)	RMSEA=0.40 IFI=1.00 χ^2=0.0 (saturated)	• Education needed to be freed to be invariant by race, gender. Not invariant by age group
McGill Pain Questionnaire	1. Sensory pain (items 1–10) 2. Affective pain (items 11–15) 3. Other pain[b] (items 17–20)	RMSEA=0.07 IFI=0.82 χ^2 (df 72)=2005.72	• Item 9 did not load and was dropped. • Invariant by race and age • Gender required 3 items freed to vary: 12, 13 and 15—all in affective.
Pain Disability Index	1. Obligatory (life support and self-care) 2. Voluntary (family, occupation, recreation social activity and sexual activity)	RMSEA=0.035 IFI=0.98 χ^2 (df 31)=108.82	• Invariant by race • Gender and age invariance could not be achieved.
Brief Symptom Inventory®c	1. Mood disorders (depression, anxiety, somatization) 2. Psychotic disorders (paranoid ideation, phobic anxiety, psychoticism) 3. Other disorders (interpersonal sensitivity, obsessive-compulsive, hostility)	RMSEA=0.08 IFI=0.96 χ^2 (df 24)=351.60	• Invariant by race, gender, age group if somatization freed to differ by group. • Obsessive-compulsive also needed to be freed to differ by gender.

Obsessive-compulsive also needed to be freed to differ by gender; a: Individual items and factor loadings are represented in Figure 1-3; b: "evaluative pain" was excluded from the analysis; c: Only mood disorders are included in the SEM model.

improvements in educational opportunities alone will be insufficient in reducing racial SES inequalities.

With the exception of a single item dropped from the MPQ Sensory Factor, the MPQ and PDI factors were confirmed as expected.[44,53] A satisfactory BSI factor related to mood disorders also allowed us to examine race and SES in relation to mental health. It is important to note, however, that like neighborhood SES, BSI mood disorders had invariance issues related to race suggesting the factors are measuring slightly different constructs for blacks and whites. Further study is necessary to better understand how race affects these factors as well as in developing and testing culturally appropriate measures before these relationships are clarified.

Racial and SES Findings

Green and others found that black race is associated with higher affective pain and obligatory disability replicates earlier studies where blacks experienced more pain and greater emotional response to pain than whites.[22,54,55] These relationships were mediated through the SES factor. However, prior findings examining mental health in blacks have yielded mixed results.[22,28,55] Unfortunately, instruments measuring depression and mood disorder vary, making results difficult to compare. An important consideration is that many mental health instruments lack cultural and linguistic sensitivity while failing to address educational or health literacy concerns. Our study confirms that blacks experience more mood disorders than whites, mediated through neighborhood SES. We found that neighborhood SES was significantly related in every case to the outcome variables with lower SES corresponding to poorer outcomes confirming earlier findings[20,26] and our hypotheses.

Complexity and Technique

The primary way our study expands the current literature is that it uses complex modeling. This methodology allows us to clarify the interactive and independent effects of race and SES, thereby allowing us to fully assess the chronic pain burden in disadvantaged communities rather than diminishing them as controlling or matching techniques do.[20,26] Both race and neighborhood SES are important factors in assessing and treating chronic pain. McCracken suggested race may be a surrogate for SES effects on pain.[21] Like Farmer and Ferraro, we found that race is not a surrogate for neighborhood SES, since neighborhood SES sometimes mediates the racial relationship and sometimes does not.[31] Low neighborhood SES was directly associated with increased sensory pain, affective pain, miscellaneous pain, disability and mood disorders. We also extend the literature by confirming that the relationship among higher neighborhood SES and decreased pain severity, pain-related disability and mood disorders does not differ by race in older adults.

There were also racial interactions related to voluntary disability with age and gender. More specifically, black women suffered greater disability than black men and white women less than white men. Blacks also reported more disability as they aged, while whites reported less. Likewise, while age did not statistically predict neighborhood SES, the direction of coefficients was opposite (blacks live in worse neighborhoods as they age and whites live in better). These interactions have important implications for examining race, poverty and disability in ethnically diverse older adults and clearly deserve further study.

Mechanisms for disparities remain complex. The literature supports clinician variability in decision-making based upon sociodemographic factors with minorities and people in disadvantaged neighborhoods at risk for suboptimal pain care.[28,56] It is also important to note that individual SES reduces but does not eliminate access disparities.[56] Segregation's importance in the inequitable distribution of both stressors and resources was described by Williams.[13,57,58] Williams also discussed the role of discrimination,[2] while Antonucci expanded the varying social support effects for people in difference social circumstances.[59] Healthcare access, social support, local resources and stressors, and increased allostatic load for people in disadvantaged neighborhoods may influence the chronic pain experience creating disparities. When combined with structural barriers to accessing pain medications in minority and lower-SES neighborhoods, our results confirm the importance in assessing both neighborhood SES and race to improve pain management.[60,61] Overall, these results provide support for continued disparities in health and healthcare for minorities. Although racial variations in the relative influence of neighborhood SES on pain scores were not statistically significant in our analysis, these results (particularly the strong relationship between race and neighborhood SES) support the needs for prospective studies in ethnically diverse populations across the life span.

This study's implications and the solutions are likely to be as complex as the relationships. It follows that infrastructure changes are necessary before health disparities begin to decline.[57] There are potentially promising studies to assist in developing interventions. Antonucci found that the perception of competent social structures helped men who had a lower education level.[59] A study in sports teams found that among blacks, team identity was stronger than racial identity, while whites in that environment perceived racial discrimination as a norm related to sports, suggesting blacks might be more competent.[62] This suggests that social systems might be developed where people from different races did not perceive different competencies; therefore, inequities would not be part of the structural system.

Limitations

Although our results support roles for race and neighborhood SES in chronic pain, there are limitations. First, this is predominantly a Michigan sample with only black and white older adults but no ethnicity measure distinguishing blacks from different backgrounds, as is preferable, was used.[63] Although Patel reported similar findings for older Mexican Americans, the relationships of neighborhood SES, race and chronic pain may differ for other minority groups, different age groups or in different regions,.[64] Second, a selection bias may exist. Our sample included patients referred to the pain clinic, indicating both physical and financial access to the pain center. Since individuals in low-SES neighborhoods have fewer financial resources and lower healthcare access, it is plausible that including people with varying access would strengthen the association between neighborhood SES and negative chronic pain outcomes, potentially expanding the role of race. Third, no information was available about pain location or etiology and whether these differ by race or neighborhood SES. Future efforts should be directed at designing studies that will allow our results to be applicable to specific populations (e.g., other minority groups, varied geographic areas, a wider age range and people with varied access to healthcare) to clarify causation relationships among neighborhood SES, race and chronic pain sequelae. Additionally, although neighborhood SES has been shown to have a strong relationship to health outcomes, individual SES measures might add additional insight into understanding this complex relationship. Lastly, the lack of racial invariance in the "neighborhood SES" and "mood disorders" factors highlight variables developed and tested among whites, which may not adequately measure constructs in an ethnically diverse population.

CONCLUSIONS

Overall, these results illustrate the importance of both race and neighborhood SES in the chronic pain experience of older adults. More specifically, race is directly associated with neighborhood SES, mediationally associated with affective pain, obligatory disability and mood disorder symptoms while indirectly associated with sensory pain, miscellaneous pain and voluntary disability. Both efforts designed to improve clinical practice and health policy may be affected by the relationship between race and neighborhood SES. Since neighborhood SES has a significant role in the chronic pain experience beyond race, age and gender, these results support including neighborhood characteristics as part of initial pain assessment. Although mechanisms underlying the association among race, neighborhood SES and chronic pain are not fully understood, we have revealed that increasing neighborhood SES improves the chronic pain experience for both blacks and whites. Understanding how race and neighborhood SES influence chronic pain may allow physicians and other healthcare providers to put the patient's neighborhood into context to direct the patient toward social or financial resources potentially assuaging the negative effects of neighborhood on chronic pain. Thus, both race and neighborhood SES are important determinants of health and well-being in individuals living with chronic pain and should be included in the initial assessment.

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REFERENCES

1. Institute of Medicine of the National Academies, et al. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*. Washington, DC: National Academies Press, 2002.

2. Williams DR, Neighbors HW Jackson JS. Racial/ethnic discrimination and health: findings from community studies. *Am J Public Health*. 2003;93:200-208.

3. Navarro V. Race or class versus race and class: mortality differentials in the United States. *Lancet*. 1990;336:1238-1240.

4. Robert SA. Explaining race differences in health among older adults. *Res Aging*. 2002;24:654-683.

5. Robert SA. Age variation in the relationship between community socioeconomic status and adult health. *Res Aging*. 2001;23:234-259.

6. Kelley-Moore JA, Ferraro KF. The black/white disability gap: persistent inequality in later life? *J Gerontol B Psychol Sci Soc Sci*. 2004;59:S34-43.

7. Schneider EC, Zaslavsky AM, Epstein AM. Racial disparities in the quality of care for enrollees in Medicare Managed Care. *JAMA*. 2002;287:1288-1294.

8. Boudreaux ED, Emond SD, Clark S, et al. Race/ethnicity and asthma among children presenting to the emergency department: differences in disease severity and management. *Pediatrics*. 2003;111:615-621.

9. Cooper RS, Kennely JF, Durazo-Arvizu R, et al. Relationship between premature mortality and socioeconomic factors in black and white populations of US metropolitan areas. *Public Health Rep*. 2001;116:464-473.

10. Williams DR, Collins C. US socioeconomic and racial differences in health: Patterns and explanations. *Ann Rev Sociology*. 1995:21:349-386.

11. Williams DR. Missed opportunities in monitoring socioeconomic status. *Public Health Rep*. 1997;112:492-494.

12. Williams DR. Race, socioeconomic status, and health. The added effects of racism and discrimination. *Ann N Y Acad Sci*. 1999;896:173-188.

13. Williams DR, Jackson PB. Social sources of racial disparities in health. *Health Affairs*. 2005;24:325-334.

14. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and incidence of coronary heart disease. *N Engl J Med*. 2001;345:99-106.

15. Robert SA, Reither EN. A multilevel analysis of race, community disadvantage, and body mass index among adults in the U.S. *Soc Sci Med*. 2004;59:2421-2434.

16. Kawachi I, Daniels N, Robinson DE. Health disparities by race and class: why both matter. *Health Aff*. 2005;24:343-352.

17. Kessler RC, Neighbors HW. A new perspective on the relationships among race, social class, and psychological distress. *J Health Soc Behav*. 1986;27:107-115.

18. Epel ES, Lin J, Wilhelm FH, et al. Cell aging in relation to stress arousal and cardiovascular disease risk factors. *Psychoneuroendocrinology*. 2006;31:277-287.

19. Cherkas LF, Aviv A, Valdes AM, et al. The effects of social status on biological aging as measured by white-blood-cell telomere length. *Aging Cell*. 2006;5:361-365.

20. Edwards RR, Moris M, Husfeldt B, et al. Ethnic similarities and differences in the chronic pain experience: a comparison of African American, Hispanic, and white patients. *Pain Med*. 2005;6:88-98.

21. McCracken LM, Matthews AK, Tang TS, et al. A comparison of blacks and whites seeking treatment for chronic pain. *Clin J Pain*. 2001;17: 249-255.

22. Ruehlman LS, Karoly P, Newton C. Comparing the experiential and psychosocial dimensions of chronic pain in African Americans and Caucasians: findings from a national community sample. *Pain Med*. 2005;6:49-60.

23. Aggarwal VR, Macfarlane TV, Macfarlane GJ. Why is pain more common amongst people living in areas of low socio-economic status? A population-based cross-sectional study. *Br Dent J*. 2003;194:383-387.

24. Andersson HI, Ejlertsson G, Leden I, et al. Chronic pain in a geographically defined general population: studies of differences in age, gender, social class, and pain localization. *Clin J Pain*. 1993;9:174-182.

25. Gerstle DS, All AC, Wallace DC. Quality of life and chronic nonmalignant pain. *Pain Manag Nurs*. 2001;2:98-109.

26. Portenoy RK, Ugarte C, Fuller I, et al. Population-based survey of pain in the United States: Differences among white, African American, and Hispanic subjects. *J Pain*. 2004;5:317-328.

27. Saastamoinen P, Leino-Arjas P, Laaksonen M, et al. Socio-economic differences in the prevalence of acute, chronic and disabling chronic pain among ageing employees. *Pain*. 2005;114:364-371.

28. Green CR, Baker TA, Smith EM, et al. The effect of race in older adults presenting for chronic pain management: a comparative study of African and Caucasian Americans. *J Pain*. 2003;4:82-90.

29. Baker DW, Carmeron KA, Feinglass J, et al. Patients' Attitudes Toward Health Care Providers Collecting Information About their Race and Ethnicity. *J Gen Intern Med*. 2005;20:895-900.

30. Schoenbaum M, Waidmann T. Race, socioeconomic status, and health: accounting for race differences in health. *J Gerontol B Psychol Sci Soc Sci*. 1997;52 Spec No:61-73.

31. Farmer MM, Ferraro KF. Are racial disparities in health conditional on socioeconomic status? *Soc Sci Med*. 2005;60:191-204.

32. Henderson C, Diez Roux AV, Jacobs Jr. DR, et al. Neighbourhood characteristics, individual level socioeconomic factors, and depressive symptoms in young adults: the CARDIA study. *J Epidemiol Community Health*. 2005;59:322-328.

33. Adelman RM. The roles of race, class, and residential preferences in the neighborhood racial composition of middle-class blacks and whites. *Soc Sci Q*. 2005;86:209-228.

34. South SJ, Crowder KD. Escaping distressed neighborhoods: individual, community, and metropolitan influences. *Am J Sociol*. 1997;102:1040-1084.

35. Soobader M, LeClere FB, Hadden W, et al. Using aggregate geographic data to proxy individual socioeconomic status: does size matter? *Am J Public Health*. 2001;91:632-636.

36. Tello JE, Jones J, Bonizzato P, et al. A census-based socio-economic status (SES) index as a tool to examine the relationship between mental health services use and deprivation. *Soc Sci Med*. 2005;61:2096-2105.

37. Yabroff KR Gordis L. Assessment of a national health interview survey-based method of measuring community socioeconomic status. *Ann Epidemiol*. 2003;13:721-726.

38. Krieger N, Chen JT, Waterman PD, et al. Painting a truer picture of US socioeconomic and racial/ethnic health inequalities: the Public Health Disparities Geocoding Project. Am *J Public Health*. 2005;95:312-323.

39. Shrout PE, Fleiss JL. Intraclass correlations: Uses in assessing rater reliability. *Psych Bull*. 1979;2:420-428.

40. Muthen B, Satorra A. Complex sample data in structural equation modeling. *Sociological Methodology*. 1995;25:267-316.

41. Kerns RD, Turk DC, Rudy TE. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). *Pain*. 1985;23:345-356.

42. Cassisi JE, Umeda M, Deisinger JA, et al. Patterns of pain descriptor usage in African Americans and European Americans with chronic pain. *Cultur Divers Ethnic Minor Psychol*. 2004;10:81-89.

43. Bird J. Selection of pain measurement tools. *Nurs Stand*. 2003;18:33-39.

44. Tait RC, Chibnall JT. Factor structure of the pain disability index in workers compensation claimants with low back injuries. *Arch Phys Med Rehabil*. 2005;86:1141-1146.

45. Derogatis LR. *Brief Symptom Inventory (BSI): administration, scoring and procedures manual*. 4th ed. 1993, Minneapolis, MN: National Computer Systems, Inc.

46. Geisser ME, Roth RS, Theisen ME, et al. Negative affect, self-report of depressive symptoms, and clinical depression: relation to the experience of chronic pain. *Clin J Pain*. 2000;16:110-120.

47. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51:1173-1182.

48. Holmbeck GN. Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: examples from the child-clinical and pediatric psychology literatures. *J Consult Clin Psychol*. 1997;65:599-610.

49. Brown RL. Assessing specific mediational effects in complex theoretical models. *Structural Equation Modeling*. 1997;4:463-485.

50. Hu LT, Bentler PM. Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification. *Psychological Methods*. 1998;**3**:424-453.

51. Chen YY, Kawachi I, Subramanian SV, et al. Can social factors explain sex differences in insomnia? Findings from a national survey in Taiwan. *J Epidemiol Community Health*. 2005;59:488-494.

52. Davey Smith G. Learning to live with complexity: ethnicity, socioeconomic position, and health in Britain and the United States. *Am J Public Health*. 2000;90:1694-1698.

53. Melzack R. *Measurement of Dimensions of Pain Experience*, in *Pain Measurements in Man. Neurophysiological Correlates of Pain*, B. Bromm, ed. Elsevier Science Publishers; 1984.

54. Edwards RR, Doleys DM, Fillinghim, RB, et al., Ethnic differences in pain tolerance: clinical implications in a chronic pain population. *Psychosom Med*. 2001;63:316-323.

55. Green CR, Ndao-Brumblay SK, Nagrant AM, et al. Race, age, and gender influences among clusters of African American and white patients with chronic pain. *J Pain*. 2004;5:171-182.

56. Kirby JB, Kaneda T. Neighborhood socioeconomic disadvantage and access to health care. *J Health Soc Behav*. 2005;46:15-31.

57. Williams DR, Collins C. Reparations: a viable strategy ro address the enigma of African American health. *Am Behavior Scientist*. 2004;47:977-1000.

58. Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep*. 2001;116:404-416.

59. Antonucci TC, Ajrouch KJ, Janevic MR. The effect of social relations with children on the education-health link in men and women aged 40 and over. *Soc Sci Med*. 2003;56:949-960.

60. Green CR, Ndao-Brumblay SK, West B, et al. Differences in prescription opioid analgesic availability: comparing minority and white pharmacies across Michigan. *J Pain*. 2005;6:689-699.

61. Morrison RS, Wallenstein S, Natale DK, et al. "We don't carry that"—failure of pharmacies in predominantly nonwhite neighborhoods to stock opioid analgesics. *New Engl J Med*. 2000;342:1023-1026.

62. Brown TN, Jackson JS, Brown KT, et al. "There's no race on the playing field": Perceptions of racial discrimination among white and black athletes. *J Sport Soc Issues*. 2003;27:162-183.

63. Williams DR, Jackson JS. Race/Ethnicity and the 2000 Census: Recommendations for African American and Other Black Populations in the United States. *Am J Public Health*. 2000;90:1728-1730.

64. Patel KV, Eschbach K, Rudkin LL, et al. Neighborhood context and self-rated health in older Mexican Americans. *Ann Epidemiol*. 2003;13:620-628. ■